WHAT IS CLAIMED IS:

1. A multichannel optical communication system for transmitting optical signals via an optical fiber comprising:

a plurality of individual WDM transmission channels;

a CDM transmission unit disposed within at least one individual WDM transmission channel of said plurality,

said CDM transmission unit comprising one or more CDM transmission channels;

a number of individual WDM transmission channels of said plurality, each transmitting a WDM optical signal on a unique wavelength within a designated bandwidth; and

said CDM transmission unit transmitting CDM optical signals within said designated bandwidth of said at least one individual WDM transmission channel.

2. The multichannel optical communication system of claim 1, further comprising a number of single frequency optical sources, each generating light within each individual WDM transmission channel transmitting said WDM optical signal, and a broadband optical source for generating light within said at least one WDM transmission channel transmitting said CDM optical signals.

3. The multichannel optical communication system of claim 2, wherein said broadband optical source comprises:

a seed source for generating light having a continuous spectrum;

an optical filter for selecting said designated bandwidth within said continuos spectrum;

at least one erbium-doped fiber amplifier for amplifying light within said designated bandwidth; and

a semiconductor optical amplifier (SOA) for reducing relative intensity noise originated from beating between different frequency components of said light within said designated bandwidth.

4. The multichannel optical communication system of claim 2, wherein said broadband optical source has a discrete spectrum with equally spaced individual spectral lines, a spectral

17. The multichannel optical fiber communication system of claim 15, wherein said CDM transmission unit comprises a common reference arm for maximizing visibility of said CDM optical signals within said second plurality of CDM transmission channels.

18. The multichannel optical fiber communication system of claim 15, wherein said optical delay lines provide time delays according to the relations: $t_1 = \mathbf{m}kt_c$, $t_2 = (\mathbf{m}+1)kt_c$ …, $t_n = (2\mathbf{m}-1)kt_c$, where **m** is the number of CDM transmission channels, t_c is a coherence time of the broadband source, and k is a numerical factor.

19. The multichannel optical fiber communication system of claim 18, further comprising a wavelength division multiplexer for multiplexing WDM optical signals transmitted via said first plurality of WDM transmission channels and a coherence division multiplexer for multiplexing CDM optical signals transmitted via said second plurality of CDM transmission channels.

20. The multichannel optical fiber communication system of claim 19, further comprising at least one optical link, a wavelength division demultiplexer and a coherence division demultiplexer for routing said modulated WDM and CDM optical signals via said optical link to said wavelength division demultiplexer and coherence division demultiplexer respectively.

21. The multichannel optical fiber communication system of claim 20, further comprising:

a first plurality of optical detectors for detecting demultiplexed WDM optical signals carried by said first plurality of WDM transmission channels; and

a second plurality of optical detectors for detecting demultiplexed CDM optical signals carried by said second plurality of CDM transmission channels.

22. A method of multichannel optical transmission via optical fiber, comprising the steps of:

providing a plurality of individual WDM transmission channels;

selecting a number of said individual WDM transmission channels of said plurality for transmitting WDM optical signals, each said WDM optical signal being transmitted via a respective individual WDM transmission channel on a unique wavelength within a designated bandwidth;

spacing between said spectral lines exceeding an electrical detection bandwidth of transmitted CDM optical signals.

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5. The multichannel optical communication system of claim 4, wherein said broadband optical source is a multimode laser comprising:

a lasing medium;

an optical filter for defining said designated bandwidth having a center wavelength at the center of said at least one individual WDM transmission channel; and

an optical cavity having length $L = c/2f_0$, where c is the speed of light and f_0 is said spectral spacing between adjacent spectral modes of said broadband optical source.

6. The multichannel optical communication system of claim 4, wherein said broadband optical source is a frequency chirped single mode laser modulated at frequency f_0, where f_0 is said spectral spacing between adjacent spectral lines of said broadband optical source.

7. The multichannel optical communication system of claim 4, wherein said broadband optical source is a plurality of single frequency lasers producing said discrete spectrum, each of said lasers is tuned and fixed at a respective wavelength.

8. The multichannel optical transmission system of claim 2, wherein said CDM transmission unit further comprising:

a light splitter for splitting light generated by said broadband optical source into a reference path and a plurality of paths designated for said one or more CDM transmission channels;

a phase modulator and connected thereto optical delay line being disposed within each path of said plurality of paths;

a reference arm disposed within said reference path whereby said reference arm is shared by said plurality of phase modulators; and

a combiner for collecting optical outputs of said plurality of paths and said reference arm.

9. The multichannel optical communication system of claim 8, wherein each said optical delay line comprises a temperature sensitive component.

10. The multichannel optical communication system of claim 9, wherein said temperature sensitive component is a temperature compensating device.

11. The multichannel optical communication system of claim 9 wherein said phase modulators and said reference arm are integrated on a single lithium niobate chip.

12. The multichannel optical communication system of claim 2, further comprising:

a WDM multiplexer for multiplexing optical outputs of said individual WDM transmission channels for transmitting said WDM optical signals and one or more CDM transmission channels for transmitting said CDM optical signals;

at least one optical fiber link for transmitting said multiplexed optical outputs therethrough;

a WDM demultiplexer for demultiplexing said optical outputs into said individual WDM transmission channels and one or more CDM transmission channels;

a plurality of WDM receivers for receiving and detecting optical outputs from corresponding said WDM transmission channels; and

one or more CDM receivers for receiving and detecting optical outputs from corresponding one or more said CDM transmission channels.

13. The multichannel optical communication system of claim 12, wherein said CDM receiver further comprises:

a splitter for splitting said demultiplexed optical output into one or more receiving paths corresponding to a number of said CDM transmission channels;

one or more optical filters, each optical filter being disposed within the corresponding receiving path for discriminating noise from said broadband source; and

one or more CDM detectors for detecting the outputs of respective CDM transmission channels.

14. A multichannel optical fiber communication system for transmitting CDM optical signals via at least one WDM transmission channel comprising:

a first plurality of individual WDM transmission channels for transmitting WDM optical signals and at least one individual WDM transmission channel for transmitting said CDM

optical signals,

each individual WDM transmission channel of said plurality comprising a single frequency optical source for generating light within said each WDM transmission channel for transmitting an optical signal on a unique wavelength within a designated range of wavelengths; and

at least one coherence division multiplexed (CDM) transmission unit disposed within said at least one individual WDM transmission channel, said at least one CDM unit comprising:

a second plurality of CDM transmission channels,

a broadband optical source for generating light within said at least one WDM transmission channel for for transmitting said CDM optical signals via said second plurality of CDM transmission channels,

a light splitter for dividing said light generated by said broadband optical source into one reference path and a number of optical paths equal to a number of CDM transmission channels,

each said CDM transmission channel comprising a phase modulator and an optical delay line interconnected therebetween, said optical delay line comprising a temperature sensitive component for stabilization of phase drift caused by environmental fluctuations.

~~15. The multichannel optical fiber communication system of claim 14, wherein said~~ broadband source has a discrete spectrum with equally spaced individual spectral lines, a spectral spacing between said spectral lines exceeding an electrical detection bandwidth of transmitted CDM optical signals.

16. The multichannel optical fiber communication system of claim 14, wherein said broadband source comprises:

a seed source for generating light having a continuous spectrum;

an optical filter for selecting said designated range of wavelengths within said continuos spectrum;

at least one optical amplifier for amplifying light of said designated wavelength range; and

a semiconductor optical amplifier (SOA) for reducing relative intensity noise originated ~~from beating between different frequency components within said designated wavelength range.~~

selecting at least one individual WDM transmission channel of said plurality for transmitting CDM optical signals therethrough;

disposing a CDM transmission unit having one or more CDM transmission channels within said at least one individual WDM transmission channel;

and

transmitting CDM optical signals via said one or more CDM transmission channels on wavelengths within a designated spectral width of said at least one WDM transmission channel.

23. The method of multichannel optical transmission via optical fiber of claim 22, further comprising steps of:

generating light beam by a single frequency optical source within each individual WDM transmission channel for transmitting WDM optical signal;

generating light beam within said at least one WDM transmission channel for transmitting CDM optical signals by a broadband optical source having a spectral width corresponding to said designated spectral width of said at least one individual WDM transmission channel;

modulating and phase delaying the CDM optical signals;

multiplexing said optical signals transmitted via said WDM and CDM transmission channels;

transmitting the CDM and WDM optical signals via an optical link;

demultiplexing an optical output from said optical link into said number of individual WDM transmission channels and one or more CDM transmission channels; and

detecting optical outputs from said selected number of WDM transmission channels and one or more CDM transmission channels.

24. The method of multichannel optical transmission of claim 23 wherein the step of phase delaying of the CDM optical signal further comprises a step of stabilizing the phase drift by inserting a temperature compensation device in a delay line.

25. The method of multichannel optical transmission of claim 24, further comprising the step of extracting of said one or more of said CDM transmission channels from said at least one WDM transmission channel for detecting the optical signals.

26. The method of multichannel optical transmission of claim 25, wherein a spectrum of said light beam in each said WDM transmission channel has a spectral range within a transparency range of said optical fiber.

27. A method of transmitting CDM optical signals via at least one WDM transmission channel, comprising the steps of:

disposing a CDM transmission unit having a plurality of CDM transmission channels within at least one WDM transmission channel,

generating a light beam by a broadband light source within said at least one WDM transmission channel;

splitting said light beam into one CDM reference light beam and a plurality of CDM light beams corresponding to said plurality of CDM transmission channels;

phase modulating said plurality of CDM light beam by optical signals;

multiplexing said one reference CDM light beam and a plurality of phase modulated CDM light beams; and

transmitting said one reference CDM light beam and said plurality of modulated CDM light beams via said at least one WDM transmission channel through said optical link;

demultiplexing an optical output of said optical link into said plurality of CDM transmission channels; and

extracting said plurality of CDM transmission channels from said at least one WDM transmission channel for detecting the optical signals.

28. The method of transmitting CDM optical signals of claim 27, wherein said broadband light source has a discrete spectrum with equally spaced individual spectral lines, spectral spacing between said spectral lines exceeding an electrical detection bandwidth of transmitted CDM optical signals and defining a maximum number of CDM transmission channels for transmitting the optical signals.

29. A method of multichannel optical transmission via optical fiber comprising the steps of:

providing a wavelength division multiplexed (WDM) transmission unit having a plurality of WDM transmission channels, each having a WDM transmitter and receiver for

carrying optical signals via said WDM transmission channels;

selecting at least one transmission channel out of said plurality of WDM transmission channels;

substituting said transmitter and receiver within at least one WDM transmission channel with a plurality of coherence division multiplexed (CDM) transmission channels; and

generating a light beam by a broadband source within said at least one WDM transmission channel for transmitting CDM optical signals on wavelengths within a spectral range of said at least one WDM transmission channel.

30. The method of multichannel optical transmission of claim 29, further comprising the step of extracting of said plurality of CDM transmission channels from said at least one WDM transmission channel for detecting said optical signals.

31. The method of multichannel optical transmission of claim 30, wherein a spectrum of said light beam in each said WDM transmission channel has a spectral range within a transparency range of said optical fiber.

32. A method of multichannel optical transmission via optical fiber comprising the steps of:

providing WDM communication system having a plurality of WDM transmission channels for carrying optical signals;

providing a plurality of coherence division multiplexed (CDM) units, each said unit comprising a plurality of CDM transmission channels;

substituting a requested number of WDM transmission channels with said plurality of CDM units, said requested number of WDM transmission channels corresponding to said number of said CDM units; and

transmitting the optical signals via said plurality of CDM transmission units.

33. The method of multichannel optical transmission via optical fiber of claim 32, wherein at least one WDM transmission channel is substituted by said CDM transmission unit for transmitting the optical signals therethrough within a designated range of wavelengths of said at least one WDM transmission channel.

34. The method of multichannel optical transmission via optical fiber of claim 32, wherein each WDM transmission channel is substituted by one CDM transmission unit for transmitting the optical signals therethrough within the designated range of wavelengths of said each WDM transmission channel.

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